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UNITED STATES PATENT APPLICATION

Title:

CAR AUDIO AMPLIFIER WITH REMOTE CONTROL PANEL

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CAR AUDIO AMPLIFIER WITH REMOTE CONTROL PANEL

Background of the Invention

Technical Field of the Invention

This invention relates generally to audio electronics, and more specifically to an amplifier with a remote control panel which contains the adjustment controls for the amplifier.

Background Art

FIG. 1 illustrates a front perspective view of a conventional car stereo system 10. The stereo system includes a head unit 12 which receives radio broadcasts, plays compact discs, and so forth. The head unit includes a master volume control 14 and various other controls. The setting of the master volume control determines the level of all of the pre-amp signals which are sent to an external amplifier 16 via one or more cables 18. The external amplifier amplifies these signals and drives them to drive a set of audio loudspeakers (not shown). The loudspeakers are connected via speaker wires (not shown) to amplifier output terminals 20. The stereo may optionally also include a remote bass boost control pod 22 which is connected to the external amplifier by a cable 24 which is generally a CAT5 cable or a custom cable. The bass boost control is only a single-band equalizer which adjusts the relative volume of one preset low bass frequency, independently of and in addition to the effect of the head unit's master volume control.

FIG. 2 illustrates a rear perspective view of the stereo system 10. The head unit 12 receives electric power at power terminals 26, and the external amplifier receives electric power at power terminals 28. The pre-amp level signals are carried over RCA cables 18 which are coupled between RCA output jacks 30 on the head unit and RCA input jacks 32 on the external amplifier. A cable 34 carries a "remote on" signal from the head unit to the external amplifier which causes the external amplifier to turn on. This same signal is commonly also routed to a power antenna (not shown), which extends when the signal is asserted and retracts when the signal is deasserted.

FIGS. 3 and 4 illustrate the front and rear of the head unit 12 in closer detail. In addition to the master volume control, the head unit typically also includes a plurality of radio station preset buttons (labeled 1 through 8), a display of some sort, a compact disc player (at the slot

1 labeled CD), a cassette tape player (not shown), and so forth in various combinations and
2 permutations. Some head units are “stereo only”, meaning that they have outputs for a Left
3 channel and a Right channel. More advanced head units are providing more channels, such as
4 Front Left (FL), Front Right (FR), Center (C), Rear Left (RL), Rear Right (RR), and Subwoofer
5 (SUB). Additionally, some head units have input terminals for receiving signals from external
6 sources, such as an external MP3 player, suggested by the auxiliary input terminals 36 (AUX IN
7 L/R). The head unit may optionally have a DIN connector 38 or, more frequently, simply a
8 bundle of wires extending out the back. A connector 40 or, similarly, a wire, provides the remote
9 on signal for the external amplifier and the power antenna.

10 FIGS. 5 and 6 illustrate the front and rear of the external amplifier 16 in closer detail,
11 including the speaker output terminals 20, power terminals 28, audio signal input connectors 32,
12 and remote on input terminal or wire 42. The head unit’s master volume control turns the
13 pre-amp level signals up and down together. Most quality stereo systems have additional controls
14 beyond the master volume control, which is necessary but inadequate alone for achieving a
15 balanced, pleasing sound. These are generally located on the external amplifier, and therein lies a
16 problem.

17 There are several sources of sound reproduction differences between the various audio
18 channels. The loudspeakers are often not identical; for example, the car may have a set of small
19 circular speakers mounted in the front doors and driven by the Front Left and Front Right
20 signals, but a set of larger and more powerful speakers mounted in the rear deck and driven by
21 the Rear Left and Rear Right signals. Or, the front speakers may be coaxial speakers which
22 include tweeters, while the rear speakers may be conventional woofers. The length of the wires
23 driving the front speakers may be significantly shorter than the length of the wires driving the
24 rear speakers, or vice versa. The front speakers may have 2ohm voice coils, and the rear speakers
25 may have 4ohm voice coils. The amplifier may provide 50 watts per channel to the Front and
26 Rear channels, but 400 watts to the Subwoofer channel. The head unit itself may have a design
27 flaw or manufacturing defect which causes a single channel to have a noticeably quieter or
28 brighter signal, and so forth.

29 To help the installer and user overcome these limitations, the external amplifier is
30 generally provided with one or more controls 44 for each channel. By way of illustration only,

1 the Front, Center, and Rear channels may have Gain (G) controls and High Pass Filter (HPF)
2 controls, and the Subwoofer channel may have a Gain control and a Low Pass Filter (LPF)
3 control.

4 However, because these channel signal controls are located on the external amplifier,
5 which is typically located in an inconvenient spot such as inside the trunk of a car, behind the
6 seat of a truck, or under the rear seat of an SUV, it is very difficult for the installer to achieve an
7 optimal setting for the set of controls as a whole and with respect to each other. The installer is
8 unable to e.g. sit in the driver's seat of a commuter's car and adjust a single channel's gain up
9 and down repeatedly, until his ear says the right result has been obtained. Rather, he has to sit in
10 the driver's seat, listen, get out of the car, go to the trunk, adjust the control, get back in the car,
11 and listen again, repeating this process until a somewhat decent result has been obtained or, more
12 typically, until he succumbs to the fact that he is being paid by the job and not by the hour.

13 However, it is generally quite impractical and undesirable to mount the external amplifier
14 in a location which would be easily accessible during the installation and initial setup. External
15 amplifiers are generally quite large, and do not readily fit into convenient places inside the
16 passenger compartment of many vehicles. Furthermore, external amplifiers can produce
17 significant amounts of heat and significant surface temperatures. It would be most undesirable to
18 have a large, heat-producing amplifier directly under a driver's legs in Phoenix during July. It
19 would be even more undesirable to have a dangerously hot amplifier located where children
20 might touch it at any time.

21 What is needed, then, is an improved stereo system which decouples the heat-producing
22 aspects of the external amplifier from its control settings.

23 **Brief Description of the Drawings**

24 The invention will be understood more fully from the detailed description given below
25 and from the accompanying drawings of embodiments of the invention which, however, should
26 not be taken to limit the invention to the specific embodiments described, but are for explanation
27 and understanding only.

28 FIG. 1 shows a front perspective view of a conventional car stereo system according to
29 the prior art.

30 FIG. 2 shows a rear perspective view of the prior art car stereo system.

1 FIGS. 3 and 4 show front and rear perspective views of a conventional head unit.

2 FIGS. 5 and 6 show front and rear perspective views of a conventional external amplifier.

3 FIGS. 7 and 8 show front and rear perspective views of one embodiment of a separate
4 control unit for an external amplifier according to this invention.

5 FIG. 9 shows a perspective view of one embodiment of an external amplifier according to
6 this invention.

7 FIG. 10 shows a perspective view of one embodiment of an external amplifier according
8 to this invention, having its remote control unit docked into the external amplifier.

9 FIGS. 11 and 12 show front and rear perspective views of one embodiment of a car stereo
10 system according to this invention.

11 FIG. 13 shows a rear perspective view of one embodiment of a car stereo system
12 according to this invention, with the amplifier control unit docked into the amplifier.

13 Detailed Description

14 FIG. 7 illustrates one embodiment of a separate control unit 50 for controlling channel
15 parameter settings of an external amplifier (not shown) such as may be used in a car audio
16 system. The control unit includes controls 52 for setting various parameters of one or more
17 channels of audio signal. In various embodiments, controls are provided for a 1-, 2-, 3-, 4-, 5-, 6-,
18 or 7-channel (or more) external amplifier. The control unit also includes the pre-amplifier
19 electronics (not shown).

20 The drawing illustrates controls for a 6-channel system, including Front (F) (with Left
21 and Right controlled together), Center (C), Rear (R) (with Left and Right controlled together),
22 and Subwoofer (SUB) channels. The Front channels are equipped with Gain and High Pass Filter
23 controls. The Center channel is equipped with Gain, High Pass Filter, and Delay controls, as are
24 the Rear channels. The Subwoofer channel is equipped with Gain, Bass Boost, Subsonic Filter,
25 Low Pass Filter, Phase, and Parametric controls.

26 Additionally, an input selector switch 54 is provided to select either the 5.1 inputs or the
27 stereo auxiliary in inputs, for example. The control unit also has optional equalizer controls 56.
28 Indicator lights 58 are provided to indicate that the external amplifier and the control unit are on
29 or off, that an over-power protection circuit has been activated, and whether the amplifier is
30 being overdriven and is clipping.

FIG. 8 illustrates the rear of the control unit 50. The rear panel includes a DIN output (and, optionally, input) connector 60, one to seven (or more) channel signal input terminals 62 such as RCA connectors, and, optionally, one or more auxiliary input terminals 64 such as RCA jacks. In operation, the control unit receives audio channel signals at the RCA inputs 62, processes those signals according to the various settings of the controls (52, 54, 56 in FIG. 7), optionally performs pre-amplification, and outputs the resulting audio channel signals to the DIN output 60. If the two-channel AUX IN input is selected (per control 54), the two-channel signals are, in some embodiments, converted to the maximum number of channels which the amplifier supports. For example, the Left auxiliary input channel may be fed to the Front Left and Rear Left channels at the DIN output, the Right auxiliary input channel may be fed to the Front Right and Rear Right channels, and the Left and Right auxiliary input channels may be combined and sent to the Center and Subwoofer channels.

FIG. 9 illustrates one embodiment of an external amplifier 70 according to this invention. The external amplifier includes power terminals 72 for receiving electrical power, RCA input connectors 73, a DIN input connector 74, and speaker output terminals (not shown) to which the amplified audio signals are driven. Thus, the amplifier includes dual, parallel inputs – the RCA jacks and the DIN connector – over which the amplifier can receive audio signals for amplification.

Optionally, the external amplifier may also include a docking bay 76 for receiving the control unit. The docking bay includes a DIN connector 78 positioned to mate with the control unit's DIN connector directly or with an intermediate cable; alternatively, it could have RCA jacks (not shown) for mating with the RCA connectors of the control unit. The primary DIN input 74 and the docking bay DIN input 78 may also be considered as being dual, parallel inputs over which the amplifier can receive audio signals for amplification, as may the docking bay DIN input and the RCA jacks. In some embodiments, all three inputs are present, in parallel, although, typically, the amplifier will only amplify audio signals from a single input source at a time.

FIG. 10 illustrates the external amplifier 70 with the control unit 50 docked. This docking option may prove useful if, for example, the car does not have a suitable mounting location for the control unit, or if the user does not wish to be bothered with it after initial setup of the

1 system. In that case, the control unit can be temporarily located inside the vehicle and coupled to
2 the external amplifier via a DIN umbilical cable, the controls can be dialed in to the desired
3 acoustic result from within the passenger compartment, and then the control unit can be moved
4 to the trunk and docked with the amplifier, with the DIN umbilical cable being removed entirely.
5 During subsequent operation, the control unit will continue to control operation of the amplifier
6 and adjustment of the various channel signals, just as if it were mounted in e.g. the dash or
7 console, but the driver will not be able to make adjustments to the gain etc. settings without
8 directly accessing the external amplifier where the control unit is docked.

9 FIGS. 11 and 12 illustrate a car stereo system 100 according to one embodiment of this
10 invention. The stereo system includes a head unit 12 which provides channel signals. The
11 channel signals are routed from the head unit to the remote control unit 50 via cables 102. The
12 remote on signal is routed from the head unit to the remote control unit via cable 104. The
13 control unit applies the gain etc. settings which the user has dialed in with the controls 52, and
14 the control unit then sends modified audio channel signals to the external amplifier 70 via a DIN
15 umbilical cable 106. If an auxiliary unit 108 is present, such as a portable MP3 player, it is
16 connected to the AUX IN inputs of the control unit via cables 110.

17 In some embodiments, all of the external amplifier controls are located on the remote
18 unit, with the external amplifier itself providing only the amplification function. In other
19 embodiments, a subset of the controls are on the remote unit, while others are located directly on
20 the amplifier; for example, it may be acceptable to locate the high and low pass filter controls on
21 the external amplifier, and only burden the control unit with the gain, delay, and other controls
22 which are far better adjusted from the listening position.

23 Other permutations have not been illustrated, but are considered within the scope of this
24 invention. For example, a set of predetermined equalizer settings could be built into the control
25 unit, such as a jazz setting, a classical setting, a rock and roll setting, a country and western
26 setting, and a talk radio setting. In some instances, it may be desirable to have these settings in
27 some measure override the settings of various ones of the controls (52); for example, a rap or
28 hip-hop setting may override the setting of the subwoofer gain and bass boost controls, and
29 substitute predetermined settings instead.

FIG. 13 illustrates a car stereo system 120 utilizing the docking option. The head unit 12 is coupled to send audio channel signals directly to the external amplifier 70 via cables 112 and a remote on signal via a cable 114. An optional auxiliary device 108 is coupled to the head unit by cables 110, in which case the user must rely on the head unit's AUX capabilities to e.g. compensate for the output signal strength of the auxiliary device and route its signals through to the outputs on the cables 112. The control unit 50 is docked inside the external amplifier, where it continues to perform its control setting functions, but where it is perhaps less accessible to the user than if it were e.g. mounted in the dash with the head unit.

Conclusion

When one component is said to be “adjacent” another component, it should not be interpreted to mean that there is absolutely nothing between the two components, only that they are in the order indicated. The various features illustrated in the figures may be combined in many ways, and should not be interpreted as though limited to the specific embodiments in which they were explained and shown. Those skilled in the art having the benefit of this disclosure will appreciate that many other variations from the foregoing description and drawings may be made within the scope of the present invention. Indeed, the invention is not limited to the details described above. Rather, it is the following claims including any amendments thereto that define the scope of the invention.